European Scientific Journal June 2015 /SPECIAL/ edition ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431

THE NEED TO OVERHAUL SCIENCE RESEARCH- CHALLENGES OF WASTED FUNDING AND IRREPRODUCIBLE RESEARCH

Dr. Deepika Bhaskar
Deputy Dean Research, The Research Council, Vice Chancellor's Office,
University of Delhi, Delhi, India

Abstract

Global science research involves finances to the tune of billions and millions of people. In 2010, the expenditure on Life Sciences research globally was US$240 billion. Still one third of science information on the net is incorrect. 85% of investment in biomedical research is wasted due to inadequate reporting. Half of the published research cannot be replicated. The most striking findings have greatest chance of making it to the leading journals that impose high rejection rates to the tune of 90% of submitted manuscripts forcing scientists to exclude inconvenient data which may otherwise be significant. The time lag for translational research is an average 17 years with huge investments for research evidence to reach clinical practice. The way science research initiatives are chosen, designed, carried out, recorded, analysed, reported, regulated and published is under scrutiny. There is a dire need to redefine priorities and ways of conducting and reporting research in order to reduce waste and inefficiency in science research. A serious re-look is required into the kind of projects funded, systematic review of previous data, conduct, writing and publication of research.

Keywords: Science research, irreproducibility, wasted funding, sequestration

Introduction

Science research has progressed over the decades and is giving rich dividends as evidenced from the quality of publications from the prestigious laboratories all over the world. There is a marked increase in competition to report research in quality journals whether at the cost of pruning inconvenient data or manipulating results to show significant outcomes [Glasziou et.al 2014; Chalmers et.al. 2014][16,17]. However, it is also very clear that a significant number of the research projects contribute nothing or very

little to knowledge, practice or policy. There is often a debate amongst the best known researchers across the world that the research we need is much less in terms of the real output that we are getting now. The research we should be investing in should be done in a better way, done for the right reasons and documented for better use by future researchers as irreproducibility and waste in research has become a major issue that is rendering presently conducted and reported research misfit to be cited and used in future. This again points to huge waste in science research already under crisis due to huge sequestration that points to a dark age for science research [Stokes, 1997; Altman, 1994; Chalmers and Glasziou, 2009; Macloed et. Al. 2014][1, 2, 3, 4].

As an example of one area of science research, it has been reported that investment globally in biomedical research is increasing with an annual estimate of around $240 million [Rottingen, 2013][5]. Still the validity of information on the internet and in journals is questionable for a variety of reasons. The level of irreproducibility and doubtful reporting has become a serious issue and needs to be addressed for more meaningful outcomes for economic reasons and in terms of scientific contribution. This article details a study made to find out the deficiencies in research decisions, design, regulation and reporting. It highlights the aspects in these four areas which have led to scientific and economic wastage in research. Though it does not offer solutions for the crisis, which are still under study, there is a clear articulation of what needs immediate attention.

I.
The waste in science research

The investment in terms of funding, experimentation, regulation and reporting of science research has come under serious scrutiny as the way research is thought of in terms of application for funding, selected, sanctioned, conducted and reported is becoming questionable. The aspects under scrutiny are the following:

1.Research decisions based on questions relevant to users of research
2. Research design, methodology and analytical interpretations
3. Regulation and management of scientific research
4. Reporting of research as unbiased, reproducible and usable

Hence, almost every aspect of the way science research needs overhaul to overcome present crisis science funding is facing. Seven aspects of wasted funding and irreproducible research are covered in the following section of the paper that call for urgent attention.

The dangers of playing safe and lack of special effort

Low priority questions continue to be answered by several scientists without realizing the relevance it may or may not have today. As continuation to work done in past, the scientists who have been in the field for sometime and have earned a name because of some initial prestigious work continue to get funding though they may be addressing the areas that need most attention today. This also points to lack of intiatives to undertake research in unexplored areas/aspects. This aspect of wastage goes undetected as the scientists have earned a name for themselves and may have 'sought-after' laboratories but their actual contribution to science research and in addressing questions which are relevant today is negligible.

Research- Basic or Applied?

Relative investment in basic and applied research is also under scrutiny. Half of the investment in research in US and UK goes to basic research. It is also reported that most clinical research stemmed from basic research [Collins, 2012; Comroe and Dripps, 1976; Grant *et.al.* 2003][6, 7, 8]. However, basic research is not valued highly as most intially promising findings with future application appear to be false positive and exaggerated. The time needed for translation of basic research is generally long with estimates between 10-20 years [Morris *et.al.* 2011][9]. This also calls for exhaustive investment in applied research which may not lead to any positive outcome after such a long period and hence, is wasted. However, efforts are being made to minimize time for application of research based on the design of the experiments and trials. The funding for applied research is also picking up with the hope of quicker solutions for the future in the 'bench to bedside' format but it requires more efforts to reduce wasting of resources. There has also been a huge disconnect between what basic research can do and what users of research really want which needs to be addressed at the earliest.

Another facet of this problem is that basic research does not provide a sufficiently reliable basis for areas like drug development [Prinz *et. al* 2011][10]. Out of 53 significant reports on cancer from basic research, Amgen, a private company, has not been able to replicate 47. This problem has also been reported by a large number of other pharmaceutical firms who have tried to pick up promising results and work further on them to develop drugs for the future. It has not been possible to reproduce what has been reported in most of the cases. Obtaining funding for replication what is already reported is always a huge struggle. However, validating the initial results is a must before experimenting further on any promising aspects [Nat. Immunol][11].

Hence, the decision of investment in the right projects having real world application is as important as the decision on funding basic or applied research and the proportion of each in the overall funding scenario.

Ignorance of previous work and absence of systematic review

An investigation into publications of highly cited journals indicates that there has rarely been a systematic review of the previous work before undertaking clinical trials [Goudi et.al. 2010][12]. In fact, many scientists were not even aware of the evidence that existed for research and trials conducted in that area [Cooper *et.al.* 2005][13]. Only four out of 446 clinical protocols studied by British research ethics committees had planned their target trials based on exhaustive study of previous data available in the field [Clark *et.al.* 2013][14]. Ignoring or not putting considerable efforts into finding out what is already known is a serious lapse and difficult to defend scientifically and ethically. It is also economically draining as rather than addressing lapses in previous study and working on the promising aspects, the same study may have been replicated with the same deficiencies and reported again in a different form. Such a huge drain on precious resources is highly unacceptable and leads to huge wastages. Without a systematic review and regard for previous study, the animal experiments are unnecessarily replicated which could have been easily avoided and animals saved for other more relevant projects. If the studies are about drugs with toxic effects or life threatening side effects, it could lead to unnecessary deaths. Also, if the previous study on any drug has shown no effect, then unnecessary enrolment into clinical trials could also be avoided. An enrolment of 7000 stroke patients in a clinical study of nimodipine could have been avoided if systematic review of previous studies had been done as the drug was already found to offer no protection [Horn *et.al.* 2001][15].

Bias in selection of previous study and designing protocols to favour desired outcomes

Lack of a systematic review is one reason for wastage, however, selecting only those studies that favour your research and promise desired outcomes is also a source of waste and falls under the scientifically unacceptable category. Conveniently pruning those findings which will put your research to doubt, selecting and reporting only those which enhance the significance of the research undertaken misleads the reader into believing something which is doubtfully reported. It also misleads users of research and future reseachers into believing and working on what is not authentic. When such results are selected for future studies, these distortions can be misleading and any replication will yield negative results.

Inadequate statistical optimization show variable outcomes

The statistical method used may also effect the outcome of research as inadequate statistical optimization may make a study irrelevant for users of research and future researchers. If similar studies chose different statistical methods for interpretation, the outcomes expected are different. This will have a significant effect in studies like clinical trials as interpretation may be different for similar trials and confusing for future studies as decisions like taking it to the next level or abandoning it depend on reported findings and their analysis. Hence, a considerable effort must go into selecting the most robust method of statistical analysis for most reliable interpretation of results.

Under reporting of research and absence of detailed written protocols

The methods of reporting research has come under severe scrutiny as documentation of research has been found to be faulty in most cases as reported earlier. Reporting of all facets of the experiments conducted in a sequential manner with the steps involved sequentially and exhaustively reported is essential for replication of the results for any future study. Writing detailed protocols before the start of the study is also not an accepted practice but investment in replicating reported research has necessitated funders and publishers to take this aspect seriously. Several standard reporting guidelines like CONSORT, STARD, PRISMA, ARRIVE etc. have been issued by prestigious publishing groups which ensure adequate reporting and set standards for future publications. There is also a move to make detailed protocols publicly available so that the exhaustive process of writing of protocols is not repeated and standard protocols are available for all studies.

Inconsistent regulatory process

Regulatory processes, government approval and ethical clearances have become extremely burdensome and time consuming. These are projected to be in the interest of safe research and for prptection of individuals involved as subjects but they are exceedingly inconsistent and vary resulting in inefficient management and wastage of precious time and funds with huge inconvenience to individuals involved. Much depends on the committees and regulators involved in these processes who must work with researchers, policy makers and subjects to see what is really needed and harmonise the guidelines and processes to specific needs rather than unwanted paper work and huge drainage in terms of time and resources.

Conclusion

The seven aspects discussed here are not the only ones which ail science research, make it irreproducible and cause wastage. However, if these are adequately addressed, most of the problems that science research is facing today can be managed for better efficiency and output. The wastage in science research due to not aligning basic research to the needs of the user, inadequate reporting of research and defective regulatory processes has led to huge economic losses. These funds could have been used to address numerous other questions which require urgent attention and are not being addressed due to funding deficits. The solutions offered at the level of policy makers, funders, researchers, users of research and future researchers is still under study and will be detailed in another paper in due course.

References:

Stokes, D.E. Pasteur's quadrant- basic science and technological innovation. Washington D.C.: Brookings Institution Press 1997

Altman, D. The scandal of poor medical research, BioMedical Journal 1994 308: 283-84

Chalmers, I. and Glaszious, P. Avoidable waste in production and reporting of research evidence. Lancet 2009. 374: 86-89

Macloed, R., Michie, S., Roberts, I. et . al. Biomedical research: Increasing value, Reducing waste. Lancet 2014. Published online. Jan 8 http://dsc.doi.org/10.1016/S0140-6736 (13)62329-6

Rottingen, J-A, Regmi, S., Eide, M., et. Al. Mapping of available health research and development data: What's there, Whats's missing and What role is there for a global observatory? Lancet 2013 382: 1286-307.

Collins, F.S. NIH basics. Science 2012. 337: 503

Comroe, J.H. and Dripps, R.D. Scientific basis for the support of biomedical science. Science 1976. 192: 105-11.

Grant, J., Green, L., and Mason, B. Basic research and health: a reassessment of scientific basis for the support of biomedical science. Res. Eval. 2003; 12:217-24.

Morris, Z.S., Wooding, S and Grant, J. The answer is 17 years, what is the question: time lags in translational research. J.R. Soc. Med 2011; 104: 510-520.

Prinz, F., Schlange, T and Asadullah, K Believe it or not: How much can we rely on published data on potential drug targets? Nat Rev Drug Discov 2011. 10: 712-13

Nature Immunology. Raising standards. Nat Immunol. 2013. 14: 415

Goudie, A.C., Sutton, A.J., Jones, D.R. and Donald, A. 2010 Empirical assessment suggests that existing evidence could be more fully in designing randomised controlled trials. J. Clin. Epidemiol. 2010. 63: 983-91

Cooper, N. Jones, D and Sutton, A. The use of systematic reviews when designing studies. Clin Trials 2005. 2: 260-64.
Clark, T., Berger, U andMansman, U. Sample size determination in original research protocols for randomised clinical trialssubmitted to UK research ethics committees:review. BMJ 2013. 346:f1136
Horn, J. et.al. Nimodipine in animal model experiments of focal cerebral ischemia: a systematic review. Stroke. 2001. 32: 2433-38.
Glasziou, P et.al. Reducing waste from incomplete or unusable reports of biomedical research. The Lancet. 2014. 383(9913):267-276.
Chalmers, I. et.al. How to increase value and reduce waste when research priorities are set. 2014. The Lancet. 383:156-65